

Persian translation of this paper entitled:

مفهوم و زمینه‌های مختلف نمودیابی ظرافت در معماری
(مطالعه موردی: گنبد سلطانیه و مسجد شیخ لطف‌الله)
is also published in this issue of journal.

The Concept and Aspects of Manifestation of Elegance in Architecture (Case Study: Soltaniyeh Dome and Sheikh Lotfollah Mosque)*

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Received: 14/03/2019 ; revised: 14/07/2019 ; accepted: 25/07/2019 ; available online: 20/02/2020

Abstract

Problem statement: Elegance is a broad and universal concept with great importance in art and architecture. However, there is a lack of theoretical understanding about the nature and manifestations of elegance in architecture.

Research Objective: The aim of this study is to recognize the place and use of elegance in the design of architectural works as an artistic theme. Using a descriptive-analytical method, the authors tried to identify the concept and types of elegance and trace its uses in Iranian-Islamic architecture.

Research method: In the first step, scholars' views on the elegance concept from two perspectives of philosophy of art and engineering design were investigated. Then a model of perceptual elegance was developed using the concept of matter (mass) and the physical and perceptual characteristics were studied. In the next step, by exploring different texts for the various possibilities of applying elegance to architecture and matching with the prepared model, its types were identified, and they were examined in the two cases of Soltaniyeh Dome and Sheikh Lotfollah Mosque.

Conclusion: The aspects of manifestation of elegance can be classified into at least three levels: at the macro level, the work may have elegance of geometry in the sense of formation process and system, spatial arrangement, placement, and orientation of elements; at the semi-macro level, we have elegance of structure and elegance of form of elements and organs; and at micro level, we may observe elegance of shell materials in terms of color, type and texture, and elegance of details in terms of connections and borders. Given the breadth and variety of its applications, the place of elegance in architecture goes beyond the expression of a particular style. The methods used by Iranian architects of the past to achieve physical elegance in its different varieties can offer inspirations for today's Iranian architecture.

Keywords: *Iranian-Islamic architecture, aesthetics, elegance, perceived quality.*

* This paper is extracted from the Ph.D. Thesis entitled "Aesthetics of Elegance; The Influence of Elegance Formal Determinants on Aesthetic Preference for Persian Domed Squares", which is being conducted

under supervision of Dr. Massud Wahdattalab and consultation of Dr. Touraj Hashemi at Tabriz Islamic Art University.

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Introduction

When it comes to aesthetic concepts, we mostly speak of the relationship and accord between its two main aspects, an aesthetic concept, and its expression. This article aims to identify the aspects and varieties of elegance, which is one of the main drivers of sensory and mental satisfaction in the audience.

Some believe that the feeling induced by elegance is more closely related to the notion of grace and should not be mistaken with the sense of beauty. Hence, some scholars regard elegance as a unique aesthetic category independent from other categories such as beauty and sublimity.

In Islamic arts, elegance has a special place among visual qualities. This is especially evident in the Iranian works of art in the fields of calligraphy, painting, illumination, poetry, tiling, marquetry, enameling, and carpet weaving.

Factors that make the physical form of an architectural work graceful and gentle must be discussed in the framework of elegance aesthetics. Because of our perceptual structure, places that induce a strong feeling of mass and force (sense of roughness) make us feel less comfortable. For example, most people find it difficult to live in a semi-finished building. Therefore, elegance is one of the essential qualities that built spaces, especially interiors, should possess to become useful to humans. There has been a strong tendency toward this aesthetic feature in Iranian historical architecture. Abolghasemi believes that Iranian architecture puts more emphasis on elegance than other architectures and points to the stark difference between Roman and Iranian domes and the elegance and charm of Iranian minarets compared to their huge counterparts in other architectures as the evidence of this claim (Abolghasemi, 2004). In an essay titled "The aesthetic category of elegance and some of its expressions in Safavid art", Mollasalehi reports that there is a high tendency in Iranian art and architecture to include elegant, graceful and miniature forms in works of art (Mollasalehi, 2006).

Pope has also praised this aspect of architectural works in Iran and recognized the combination of elegance and power projection as the prominent feature of Iranian architecture in Timurid and Safavid eras (Pope, 1994).

Considering the importance of elegance in art, and especially in Iranian art, it is necessary to understand the role of this quality in the art form that is involved the most with our everyday life, namely architecture. Therefore, this paper is an attempt to examine the role and different representations of this feature in Islamic architecture of Iran in order to provide a new reading of this architecture. The most important questions that arise in this endeavor are as follows: what is the role of elegance in architecture and what aspects and manifestations of this quality can be found in Iranian architecture?

Research Method

The study was designed as a descriptive-analytical research with the purpose of examining the concept of elegance and its application in different architectural areas and situations. Data collection has been performed using library and documentary methods. First, the views of scholars on the nature and features of elegance from the perspectives of philosophy of art and engineering design were reviewed. Then, a model of visual elegance was developed based on the concept of matter. Next, the literature was searched for the use of the words elegance and elegant to describe architectural features and the results were classified and analyzed with the help of the model. Two masterpieces of Iranian architecture were chosen to serve as specific subjects for the study: (1) Öljeitü's mausoleum in Soltaniyeh, which belongs to the Ilkhanid period (1304-1312 A.D.) and has influenced many subsequent architectural works in Iran, and (2) Sheikh Lotfollah Mosque in Isfahan, which is a unique monument belonging to the Safavid period (1602-1618 A.D.). These two buildings were chosen because they share many features with their preceding and subsequent architectural works,

which make them a perfect choice for studying the quality of elegance in Iranian-Islamic architecture.

Research background and theoretical foundations

• Definition of elegance

The closest translation of the word “elegance” in Persian is “*Zerafat*”, which also means shrewdness, sharpness, mastery, skillfulness, agility, cheerfulness, being good-natured, jesting, and beauty (Dehkhoda, 1998). In the field of art, delicacy of handling means using sophisticated techniques in an exact and masterful way to make a work of art beautiful (Pakbaz, 2011: 351).

In addition to elegance, “*Zerafat*” can be translated as grace, delicacy, and subtlety. The word “grace” has been translated into Persian as “*Lotf*” and “*Melahat*”. The root of “grace” is the Latin word “*gratia*” from “*gratus*”, which means pleasing and refers to the quality of pleasantness and attractiveness, especially in relation to the subtlety or refinement of movement, action, expression, or behavior (Oxford English Dictionary, 1993). According to Encyclopedia Britannica, elegance (from the root *eligo*, meaning “I choose”) means doing or saying something in a polite, pleasant, and careful way.

Concept of elegance

The concept of elegance has been used and discussed in many fields. In this paper, we examine the definition of this concept in the fields of philosophy of art and engineering design, which have a closer relationship with architecture. In the philosophy of art and aesthetics, this concept has been discussed under the term “grace” from a semantic perspective¹.

• Elegance in the philosophy of art and aesthetics

The term aesthetics was first introduced in the eighteenth century by Baumgarten², who is known as the father of modern aesthetics. In his definition, aesthetics is the science of the sensuous perception and cognition (Baumgarten, 1750). At the same

time, scholars showed great attention to the qualities that excite emotion and feelings. Grace (elegance) along with beauty and sublimity were the three qualities that were extensively discussed by Hogarth³, Burke⁴, and Schiller⁵. In the nineteenth and early twentieth centuries, Spencer⁶ and Bergson⁷ made explicit references to this concept. In the opinion of these scholars, the emphasis is on the relation of grace (elegance) to features such as variety, motion, freedom, ease of appearance, curvature and continuity. Among these, curvature can be considered the most important physical manifestation of grace (elegance) (Table 1). It should be noted that, typically, the areas of interest to these scholars were visual and performing arts.

In the contemporary period, these views have been expanded to general art and architecture (Mollasalehi, 2006; De Botton, 2009; Goldblatt, 2008). Mollasalehi (2006) has outlined the distinctions between the concept of Grace (*Lotf*) and beauty (*Jamal*) and sublimity (*Jalal*) and its forms and themes in Islamic art and described it as having unique stylistic features, motion, luminosity, radiance, miniature forms, and variety in coloration.

• Elegance in engineering and design sciences

Since the end of the 20th century, the concept of elegance from both formal and functional point of view has come to the attention of theorists in various fields of engineering. This definition of elegance is closely associated with the expansion of the relationship of design science with mathematics and computing. Experts in this field believe that the elegance of a system improves its efficiency and productivity. Gelernter has described elegance as a feature that makes things easier to use (e.g. needing less memory, less physical force, fewer components, etc.) and calls it an effective alliance between simplicity and power (the ability to perform a wide range of tasks) (Gelernter, 1998). Newer definitions of elegance have emphasized its role as a reducer and regulator of complexity and its relation to creativity. According to Madni, an elegant design involves high levels of functional creativity (Madni,

Table 1. Features of elegance/grace according to classic scholars. Source: authors.

Theorist	Definitions/descriptions of grace	Features
Hogarth	- The serpentine line (line of grace) has the power of super-adding grace to beauty - The most graceful forms have the least straight lines (Hogarth, 2010).	serpentine lines / variety / motion / continuity
Burke	- Gracefulness and beauty are similar ideas. - The magic of grace lies in the ease, roundness, and delicacy of attitude and motion. - Beauty is in variety, smallness, smoothness, gradual variation, delicacy and brightness of colors (Burke, 1990).	ease / roundness / motion / smoothness/ smallness / gradualvariation / brightness of colors
Schiller	- “Grace is a changeable beauty.” - “Grace is aexpression of a beautiful soul.” - Grace lies in the freedom of movements. (Schiller, 1992)	expression of a beautiful soul / changeable beauty / beauty of movement / freedom
Spencer	- Graceful movements require less effort and they are energy saving. - Continuity is a leading trait of grace. - The pleasant of grace has its subjective basis in Sympathy (Spencer, 1891).	ease / effortlessnes / economy of force/ curved motion / continuity / sympathy
Bergson	- Grace is the perception of a certain ease in movements that helps one to more easily understand the movements that follow; hence, the curved lines are more graceful than the broken lines (Bergson, 1910). - Gracefulness is an immateriality that passes through matter and overcomes its resistance (Bergson, 1917).	ease / curved line / forward and backward connection and consistency (foreseeable) / overcoming the resistance of matter

2012, 347). In the field of system design, a system is said to be elegant if it can provide a sufficient solution to a given problem with the least complexity (Efatmaneshnik & Ryan, 2018).

In the field of art and architecture, De Botton has linked the notion of elegance and its related concepts in the philosophy of art to the complexity paradigm. Citing a variety of examples, he has described how the perception of elegance is associated with the perception of ease and simplicity. He has argued that simplicity is a prerequisite for elegance, but this simplicity must be achieved by overcoming a complexity (De Botton, 2009, 171).

Rahim and Jamelle were the first to use the term elegance to refer to the aesthetic aspect of digital architecture (Rahim & Jamelle, 2007). In fact, the Special 2007 Issue of the Journal of Architectural Design was wholly dedicated to this concept. The articles printed in this issue spoke of the elegance as a design solution and strategy, stating that new design techniques and instruments have paved the way for the emergence of a new definition of elegance in architectural discourse. In this regard,

complexity, system and process theories have been cited in support. According to Picon, the concept of elegance has been used for aesthetic characterization of “integrated complexities” and as a tool “to reconcile simplicity and complexity” (Picon, 2013, 121,125). Assuming that simple designs are threatened by the risk of “uniformity”and sophisticated designs are exposed to the risk of “ambiguity and confusion”, the elegant design is to pass of these risks with experience and skill (Pakzad, 1991, 36-38). Table 2 outlines the most important views about architectural elegance from a complexity perspective.

• **Elegance in architecture and its relation to matter**

As the above review suggests, the quality of elegance has been described with features such as ease, ease in undertaking a difficult task, simplicity in complexity, and economy of energy or matter. The antonyms of elegance including bulkiness, heaviness, massiveness, coarseness, gravity, roughness, ponderousness, and dryness are all related to the concept of matter. Further, another

Table 2. Contemporary views about elegance in architectural design. Source: authors.

Theorist	Definitions/descriptions of elegance	Features
DeBotton	<ul style="list-style-type: none"> - Elegance can be seen as a complexity that has given the simple appearance by the genius of the artist. - For an architectural work to be called elegant, it should not only be simple, but also have achieved this simplicity by overcoming natural or technical challenges (DeBotton, 2009). 	<ul style="list-style-type: none"> - Ease in performing a difficult task - Being simple in all of its complexity - Modesty, economy and power
Rahim & Jamelle	<ul style="list-style-type: none"> - The concept of elegance can push forward the contemporary architectural discourse by accepting that complex architectural compositions require an accompanying visual aesthetic as complicated as the current techniques used to generate form. - Adding a layer of aesthetic sophistication to the architectural design requires the use of the emerging paradigms of generative techniques and systemic logic of thought (Rahim & Jamelle, 2007). 	<ul style="list-style-type: none"> - Beauty of complex structures - Systematic approach
Schumacher	<ul style="list-style-type: none"> - Elegance can articulate complexity. - An elegant composition represents an ordered complexity. - Elegance enhances the legibility of a complex system. - Elegance of minimalism thrives on simplicity, but elegance in parametric architecture thrives on complexity and achieves a visual reduction by sublation rather than elimination (Schumacher, 2007). - Assembly of components with a reductive approach to form contradicts elegance. - New engineering tools can break a structure into particles rather than parts in order to prevent sudden changes in the arrangement of forces (Schumacher, 2008). 	<ul style="list-style-type: none"> - Reduced complexity - Ordered complexity - Visual simplification - Legibility - Gradualness - From parts to particles
Goldblatt	<ul style="list-style-type: none"> - Lightness and fluidity are two contingently related conditions of a particular type of elegance that has come to the fore with digital architecture. - Since moving objects appear lighter than static objects, elegance is often accompanied by some fluidity and softness in surfaces and forms. - The new elegance is not a product of pure formalism, but rather ensures that the traces of process are embodied as elegant qualities in architectural formations (Goldblatt, 2007). 	<ul style="list-style-type: none"> - Lightness - Fluidity and softness - Elegance in form generation
DeLanda	<ul style="list-style-type: none"> - Elegance of materials refers to objective processes (natural or artificial) where there is a measurable economy of the means to achieve a given result. This can be achieved in a variety of ways that can be examined in the probability (solution) space. - There are forms of irreducible complexity that alone represent elegance (DeLanda, 2007). 	<ul style="list-style-type: none"> - Economy of means and consumables - Optimality - Elegance in simplicity - Elegance in complexity

feature that has been greatly emphasized in the descriptions of elegance is the movement and dynamism. Therefore, it can be said that the quality of elegance has an inverse relation with the sense of matter or force and direct relation with the sense of motion (soft and gradual variation).

Two factors are involved in the creation of the sense of motion in architecture: time and light. Concerning the role of light in the perception of elegance, Goldblatt states that in addition to lightness in its gravitational sense, elegance is clearly related to light as the opposite of darkness, because the medium of light is weightless (Goldblatt, 2007). Light creates penumbra, which in turn induce movement and push the time forward. The relation of time and elegance depends on the perceived rate of change. According to Falamaki, the four aforementioned factors, namely matter, force, light, and time are the basic architectural

motifs and the purest things from which “form” can be generated. The unique features of these motifs are amorphousness, interdependence, inter-transformability, and abstractness (Falamaki, 2008, 297). The relation of these factors to the perception of the elegant form can be described as illustrated in Fig.1.

Physical and perceptual features of elegance

From a physical viewpoint, elegance has been described with features such as division (Mollasalehi, 2006), fineness, slenderness (De Botton, 2009), brightness (Goldblatt, 2007), clearness and Legibility (Pakzad, 1991; Schumacher, 2007), transparency and radiance (Mollasalehi, 2006) variety while retaining continuity and integrity (Schumacher, 2007), and in other words soft variety, which can be linked to the

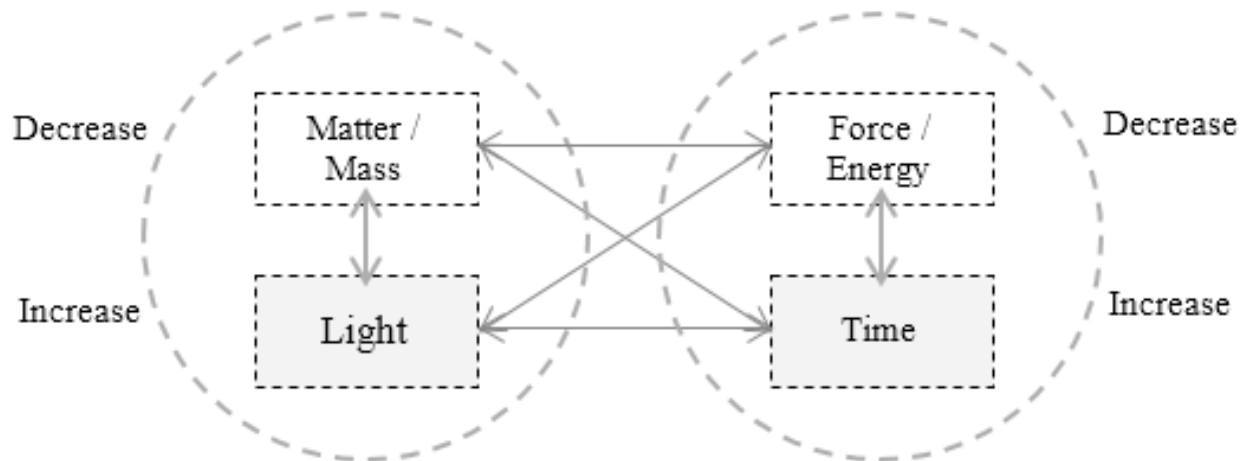


Fig. 1. A model of elegance in architecture based on the four factors shaping the architectural body. Source: authors.

notions of to the notions of perceptual lightness, ease, and richness.

lightness, ease, and richness. In contrast, the contingent (situation-dependent) effects of the qualities that oppose elegance are heaviness, hardness, fatigue, and boredom

heaviness, hardness, fatigue, and perceptual boredom (Fig. 2).

The form of elegant objects purposefully invites the audience’s eye to follow its shape. Any obstruction or interruption in this visual pursuit will undermine the elegance. This property can be explained by the Gestalt law of continuity, according to which people tend to perceive continuous elements as a single hybrid form (Lang, 2014). In fact, continuity and cohesion enhance the aesthetic pleasure by facilitating the processing of visual input. Stimuli with features such as symmetry, continuity, repetition, etc., create a sense of cohesion, which make them more pleasing (Arnheim, 1971). However, over-integration of perceptual inputs causes mental boredom and sensory fatigue (Berlyne, 1971; Biederman & Vessel, 2006). Therefore, at the perceptual level, aesthetic pleasure is generated by stimuli that satisfy our need for both integration and variety (Post, Blijlevens & Hekkert, 2016). The ability to offer both variety and continuity (integration) is the thing that makes curved lines

visually appealing and one of the elements of elegance. Various experiments have confirmed that humans prefer curved stimuli over angular ones (Silvia & Barona, 2009; Palumbo & Bertamini, 2016).

Aspects of elegance in architecture

According to the above discussions, the quality of architectural elegance is largely dependent on how the matter is worked in relation to light and time. Accordingly, the concept of elegance in architecture can be examined from the five main aspects of form, materials, details, structure, and geometry.

• Elegance of form

- Smallness/fineness/slenderness/shalowness

One way to make elegant use of materials is to divide them into smaller dimensions to make their presence less imposing or reduce their massiveness. The use of finer and smaller forms induces a sense of movement and agility (Mollasalehi, 2006, 14) as is evident in the form of muqarnas (Fig. 3). Slenderness or elongation (horizontal, vertical, diagonal, or curved) is another factor that makes a form more elegant. This effect can be attributed to the reduced presence of matter as well as increased mobility and dynamism.

According to Meiss, slenderness has a “poetic power” (Meiss, 2012, 231). Since slim, thin, and

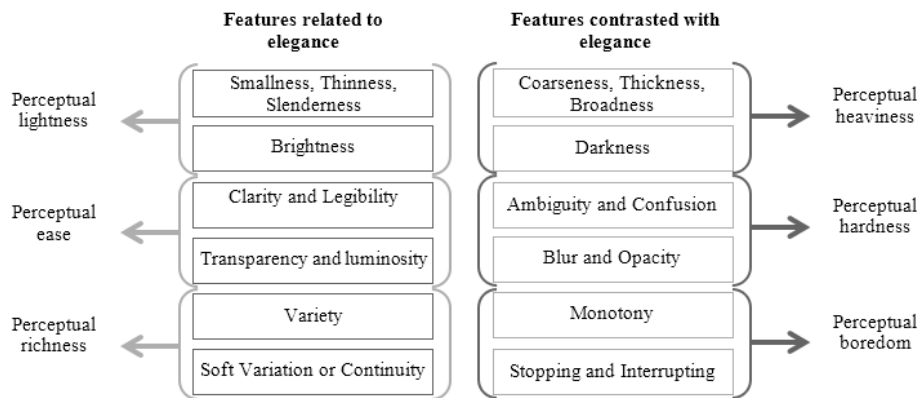


Fig. 2. Physical features of elegance and inelegance and their contingent perceptual effects. Source: authors.

elongated lines represent continuity, using linear motifs and patterns facilitate the induction of a sense of elegance. Another representation of the slenderness is the shallow depth of windows, vaults, niches, and visible edges of elements. For example, this feature can be seen abundantly in Sheikh Lotfollah Mosque in the windows around the dome and the arched panels of the entrance facade. In the Soltaniyeh Dome as Pope has pointed out, the shallowness of muqarnases in the transition zone has generated a sense of smoothness in the interface of dome circle and the polygon beneath it (Pope, 1994, 209); (Fig. 3).

- Curvature/concavity/bending/soft transition

The presence of curvature in lines and surfaces can also generate a sense of elegance. Having curvature in surfaces implies mobility, which induces a sense of lightness (Grutter, 2004, 288). Arched forms seem to create not only a sense of lightness but also continuity and consistency which improve the elegance of appearance. By ensuring the gradual transformation of the form, continuity reduces the prominence of individual elements, causing the form to emanate a sense similar to that found in the human body (Meiss, 2012, 102-103). Therefore, it is common to design architectural forms with some specific solutions to deal with corners and angles that generate perceptual roughness (See Fig. 3).

• Elegance of shell materials

Type, texture, and color of the materials used in the outer surfaces of a building can influence its perceived elegance. Some materials, such as metals

(especially gold and silver) and crystals, appear to have an inherent elegance, which is attributable to their ability to reflect light. In fact, the reflection of light from smooth surfaces and the gradual transition from brightness to darkness in an uninterrupted flow makes the material appear fluid and elegant to the eyes of the viewer. In many prominent architectural works, the elegance of curved and circular forms of the domes is emphasized by the delicate use of materials (Fig. 4).

Color is also of great importance for the perception of elegance. Given the association of elegance with light and brightness (Mollasalehi, 2006; Goldblatt, 2007) opaque colors and darker shades tend to undermine elegance and softness. Good examples of the use of color to create a sense of elegance can be found in the colorful stucco of Soltaniyeh Dome and tile decorations of Sheikh Lotfollah Mosque (See Fig. 4). Elegance in shell materials becomes more pronounced when they are blended and made with great attention to details.

• Elegance of details (connections and borders)

Details include tiny elements and connections. Architectural details can illustrate and highlight not only desirable features and strengths such as precision, clarity, control, and subtlety, but also flaws such as superficiality, excess, overcrowding, and over-designed (Garcia, 2014, 17). Describing details in terms of small size does not necessarily deliver its intended meaning in architecture; rather, details in architecture refer to a connection that

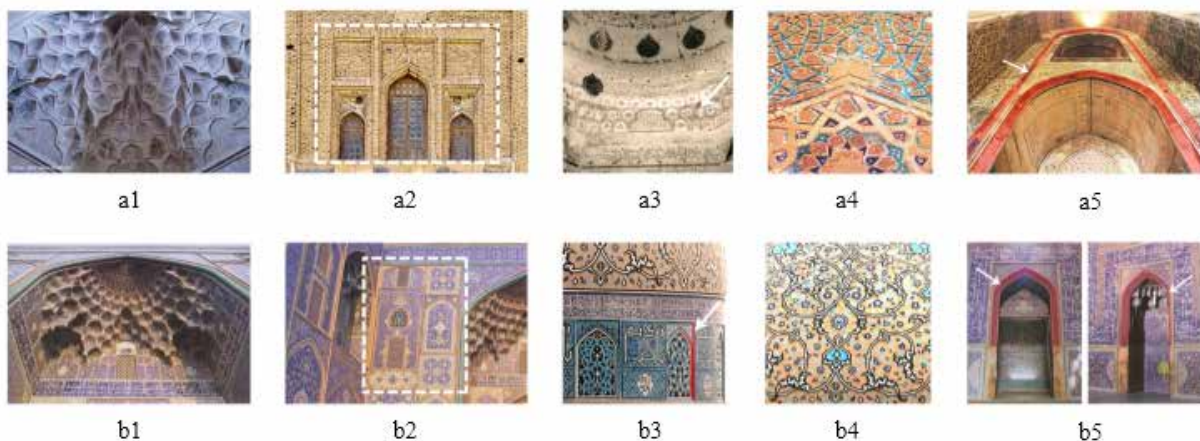


Fig. 3. Examples of the formal elegance in Soltaniyeh Dome (a) and Sheikh Lotfollah Mosque (b). a1 and b1: smallness, curvature and concavity, Sources: <https://yphc.ir> and Ganjnameh, 2015; a2 and b2: Façade segmentation, elongation, slenderness and shallowness, Sources: Ibid.; a3 and b3: shallowness and smallness, Sources: <https://archnet.org> and authors; a4 and b4: linear patterns and eslimi (arabesque) designs, Sources: Ganjnameh, 2010 and authors; a5 and b5: bending and soft transition, sources: Ganjnameh, 2010 and 2015.

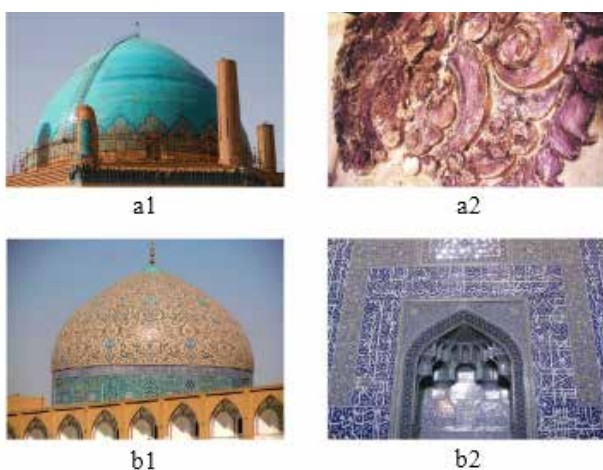


Fig. 4. Examples of elegance of shell material and coloration. a1: surface smoothness and softness of tile color in Soltaniyeh Dome, Source: <http://makanbin.net>; a2: interior, colorful stucco decoration, Source: Ganjnameh, 2010; b1: dome tiling in Sheikh Lotfollah Mosque, Source: www.arthut.ir; b2: Reflection and glitter created in the altar by the use of tile materials, Source: authors.

can be between materials and elements or a formal connection between inside and outside (Frasconi, 1984). As previously stated, movement and continuity play a key role in the manifestation of elegance, and hence any disruption can undermine elegance. However, it is sometimes necessary to have disruption and even conflict for zoning and regulation purposes. Therefore, higher attention should be paid to precision in transitions in forms or compositions and also on the edges and borders of the elements. When done precisely, elegant

details can create a pleasant feeling in the audience. A good example of this elegance is the dynamism created by the decorative details of iwans and cornice muqarnases in the Soltaniyeh Dome (Fig. 5). The important point about these details is that their dimensions have been carefully chosen according to the perspective and the height of the work (Sobuti, 2001, 91). In the Sheikh Lotfollah Mosque, the elegance of details can be observed in the subtle transition from the square space to the octagonal space. In this part of the mosque, decorative twists positioned at the margins of the octagonal arches (four sides and four corners) are intended to guide the vision and clarify the appearance (Fig. 5).

• Elegance of structure

Given the relationship of elegance with the economy of force and material, the elegance of architecture is also related to the mechanisms of load-bearing and transfer in the structure. According to Schumacher, elegance by visual reduction cannot be achieved without a matching approach to structural engineering (Schumacher, 2008). Bradshaw believes that structural elegance is to achieve the most efficient structural system with the least use of materials by maintaining constant awareness of the flow of structural forces during design (Bradshaw, 2008). Abolghasemi has emphasized the importance of correspondence between load-bearing

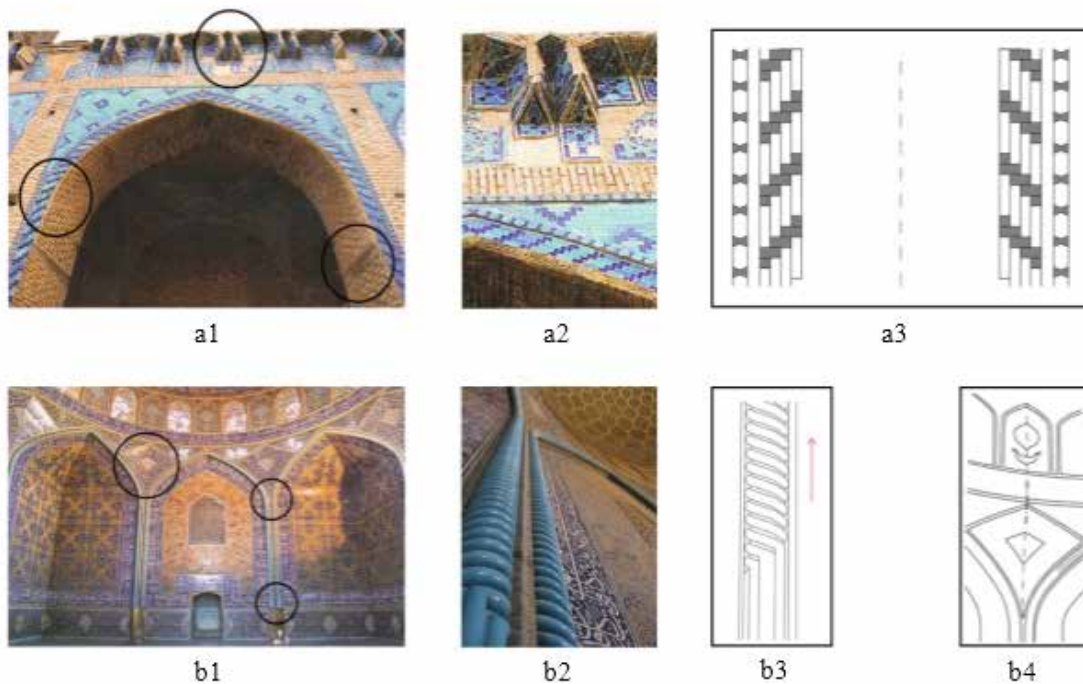


Fig. 5. Creating clarity and guiding vision with the elegance of details. a1 and a2: Examples of the elegance of details on the exterior of Soltaniyeh Dome, Source: Ganjnameh, 2010; a3: Linear design of the octagonal ornamental borders and diagonal lines to guide vision, Source: authors. b1: Examples of elegance of details in the interior of Sheikh Lotfollah Mosque, Source: Ganjnameh, 2015; b2: Decorative twists on the border of octagonal arches, Source: authors; b3: Linear design of decorative twists; b4: Linear design of details in transition area, Source: authors.

elements and applied forces in their traditional meanings and the “conscious use of the interaction of forces”⁸ for the elegance of architectural works (Abolghasemi, 2004, 388). Taking advantage of the interaction of forces to reduce the size of load-bearing elements requires specific construction techniques. For example, in many Iranian domes, the arch of the dome matches the thrust line and has been built with the least possible thickness (Ibid.). In this regard, Falamaki argues that the reason for using arches and vaults in Iranian architecture is to transfer compressive forces with the minimum use of material (Falamaki, 2013, 327). According to Falamaki, the fundamental reason for the durability of dome building custom is the active involvement of time in architectural creation (Ibid, 336). Iranian architecture contains numerous examples of structural and physical elegance, considering the construction techniques of the time. Placing minarets on both sides of iwan is a clear example of exploiting the interaction of forces. The placement

of minarets around the Soltaniyeh Dome is another example of aligning forces so that the compressive forces of these elements play an effective role in controlling the dome’s thrust forces (Sobuti, 2001, 69). Also, the use of arched ribs in the structure of the dome of Soltaniyeh can be seen as a measure to lighten the structure. In fact, the dome of Soltaniyeh, despite being large, is a lightweight structure, which makes it reminiscent to the Sky Arch (Pope, 1994, 209). This dome gets lighter with height in a precise manner and its weight is transferred to the foundation by a sequence of interconnected arches (Brambilla, 2012); (Fig. 6).

In the Sheikh Lotfollah Mosque, the maximum diameter of the dome is approximately equal to the size of each side of the base square and the surrounding vaults not only play a functional role but also contribute to the structural balance. The single-shell dome is in harmony with the overall form and geometry of the structure, which is structurally (although not necessarily formally) more elegant

than the discontinuous double-shell domes (Fig. 6). It can be argued that in this mosque, the structural function of elements follows the overall form of the building, which has a perfect geometry that guarantees its stability (Hejazi, 2008, 36).

• Elegance of geometry (network of relationships, formation system and formation process).

Here, the term geometry refers to the system of relations between elements and components and the geometry that dominates visual composition in plan, facade, exterior body, and interior space. A design is said to be elegant in geometry when the visual composition and relationship of components are arranged with a particular order and proportion that is dynamic and at the same time cohesive and continuous. Light and time play a crucial role in the perception of geometric elegance.

Geometric continuity and dynamism can be experienced in three dimensions (geometry of volumes) as well as two dimensions (geometry of surfaces). By applying mathematics, Islamic

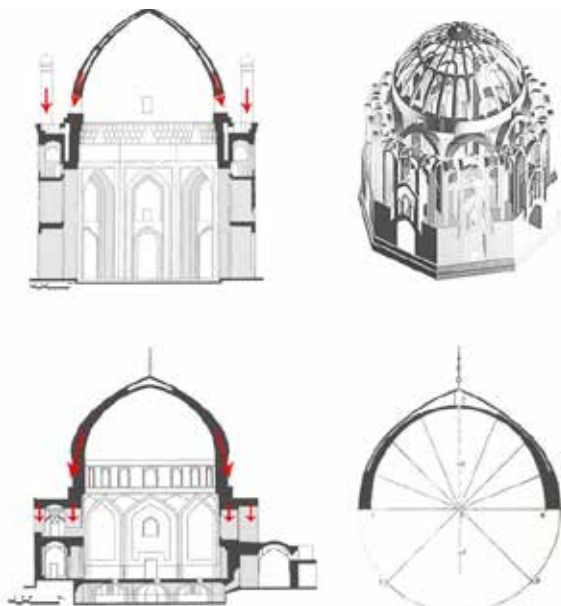


Fig. 6. Examples of structural elegance. a1: elegance of dome structure and interaction of forces in Soltaniyeh Dome, Source: authors based on Ganjnameh, 2010; a2: structural cohesion with the system of interconnecting arches, Source: Brambilla, 2012; b1: Harmony of form and structure in Sheikh Lotfollah Mosque, Source: authors based on Ganjnameh, 2015; b2: schematic diagram of the dome, Source: Memarian, 1988.

architecture has created a complex geometry that induces a sense of dynamism, unity, and continuity. Today, this dynamism and geometrical elegance can be found abundantly in digital and parametric architecture, which requires interaction between the components participating in visual compositions. Examples of this type of elegance can be seen in the organization of relationships between components and geometric order in the interior of Sheikh Lotfollah Mosque.⁹This space emits a sense of wholeness, ease, and simplicity without reduction, which is akin to the sense of economy and optimality. The use of proportional systems is effective in creating cohesion and continuity. The analysis of the plan of the Sheikh Lotfollah Mosque has shown the geometric continuity of the prayer hall with the position of the entrance at the side of the court (Dahar & Alipour, 2013, 38). Also, the geometric analysis of the entrance facade of this mosque based on regular pentagon has shown that there are precise relationships between the components of this facade (Navai & Haji Qasemi, 2011, 134). A common pentagonal pattern can be defined for geometrical analysis of the domed squares façades (Wahdattalab & Ghadimzadeh, 2018). Here, the façades of Soltaniyeh Dome and Sheikh Lotfollah Mosque have been analyzed by the use of pentagonal geometry (Fig. 7).

Besides proportional systems, continuity can also be achieved through soft transitions and spatial interlocking (Schumacher, 2007, 34). In Soltaniyeh Dome and Sheikh Lotfollah Mosque, geometric elegance is the result of continuity and transparency in the plan, which has been achieved through dynamic spatial relations and circulation in harmony with the geometry of the light, as well as geometric interlocking in the facade (See Fig. 7).

Discussion

This research began with raising question about the role of elegance in architecture. To answer this question, first, the nature of the quality of elegance was studied and a model of this quality

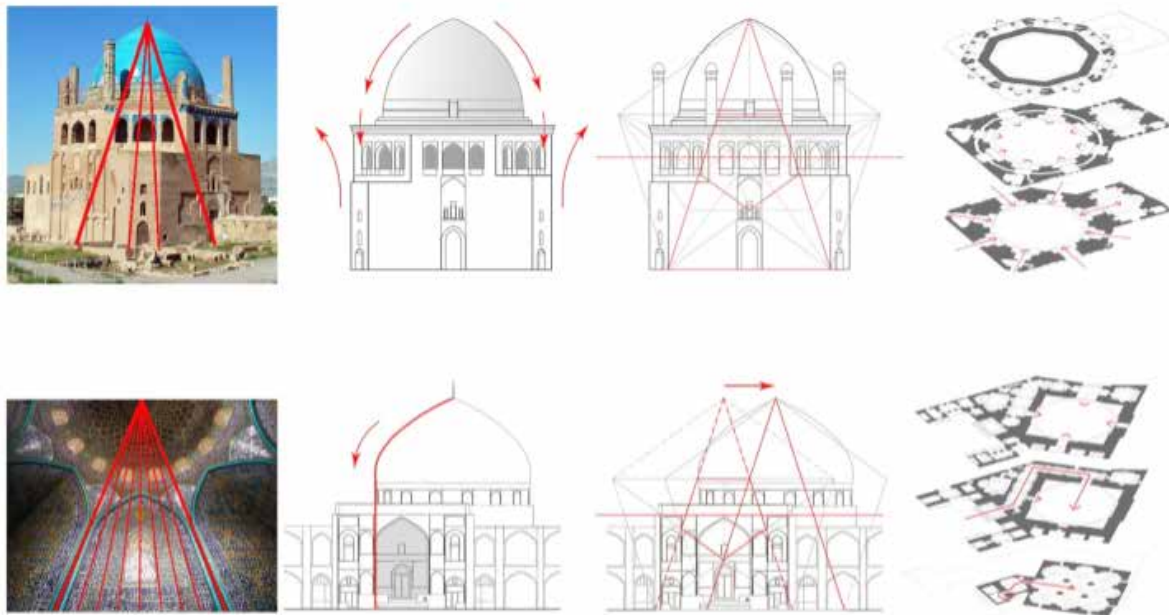


Fig. 7. Examples of geometric elegance. Left: formal continuity in the exterior of Soltaniyeh Dome and the interior of Sheikh Lotfollah Mosque, Sources: <http://soltaniyeh.ichto.ir> and www.designboom.com, drawing by authors. Right: geometrical relations in plans and facades, Source: authors based on Ganjnameh, 2010 & 2015.

was developed based on the concepts of matter, force, light and time. Assuming a single definition for architectural elegance in different periods, five fields of the use of this concept were identified and the important features of each were extracted (Fig. 8). While previous studies have often emphasized a single aspect of elegance in architecture, for example in structure and tectonics (Abolghasemi, 2004; Schumacher, 2008), ornamentation and graphics (Mollasalehi, 2006), and design process aimed at complexity reduction (Rahim & Jamelle, 2007; Schumacher, 2007), this study modeled various dimensions of this concept and examined them in two masterworks of Iranian architecture. The investigated aspects can, in fact, represent different levels or degrees of incorporating elegance in architecture. Among the five aspects of elegance, geometric elegance can be judged at the macro level, that is, for the entirety of architectural design, because it represents the totality in which the relationships of the components are considered; the totality that, while being simple in appearance, supports an interlocking network of relations. Although structural elegance may also

be categorized as macro in terms of contributing to the work, it appears to be a function of geometric elegance and is certainly associated with the formal elegance of elements, which both must be discussed at the semi-macro level. Finally, the elegance of the materials and the elegance of the details must be analyzed and discussed as micro-level qualities. The expression of elegance can occur in one or more of the introduced fields or types. These aspects are interdependent and have binary relationships with each other, for example, between structural elegance and elegance of details (See Fig. 8).

In Iranian architecture, which is closely related to geometry and mathematics, various aspects of this concept can be found together. With regard to the works examined in this study, it can be claimed that the architects have been implicitly aware of this quality and included it not only in ornamentations but also in geometry and structure.

Conclusion

Aspects of manifestation of elegance in architecture can be classified into at least three levels: (1) macro level, which includes elegance of the geometry of

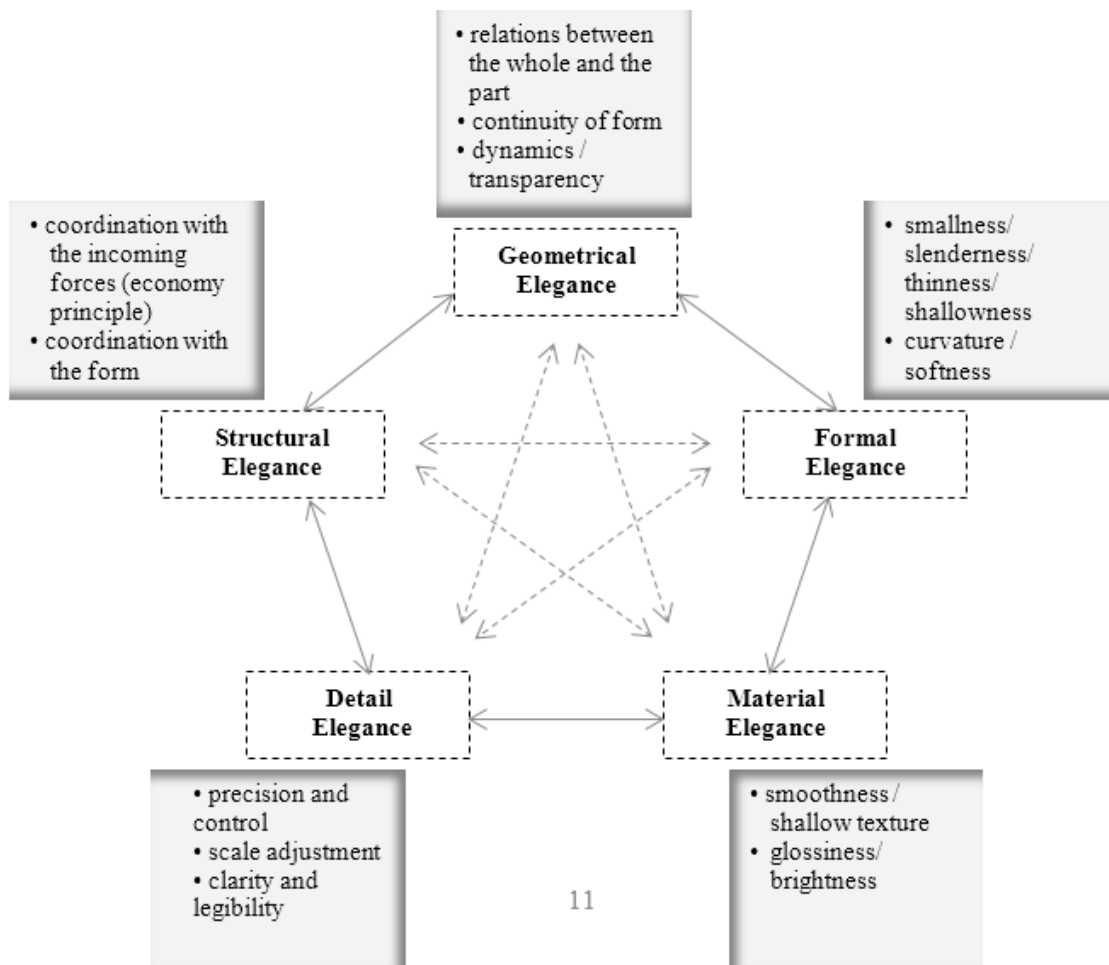


Fig. 8. Aspects of manifestation of elegance in architecture. Source: authors.

the building in the sense of formation process, spatial arrangement, placement, and orientation of elements; (2) semi-macro level, which includes elegance of structure and elegance of form of elements and organs; and (3) micro-level, which includes elegance of shell materials in terms of color, type and texture, and elegance of details in terms of connections and borders. Given the breadth and variety of its applications, the place of elegance in architecture goes beyond the expression of a particular style.

One can always expect a level of elegance in important architectural works, and successful architects have never overlooked this aesthetic feature. Regarding the works studied in this paper, it can be claimed that the timely use of

elegance in its different varieties is among the chief positive traits of Iranian architecture. Throughout history, Iranian architects have used sophisticated techniques to express elegance in different aspects of their works, and these expressions can serve as an inspiration for form generation in today's Iranian architecture.

Endnotes

1. In the philosophy of art, this concept has been referred to with the terms elegance and subtlety as well as grace, but grace has a broader meaning and has been discussed more frequently.
2. Alexander Gottlieb Baumgarten (1714-1762)
3. William Hogarth (1697-1764)
4. Edmund Burke (1729-1797)
5. Friedrich Schiller (1759-1805)
6. Herbert Spencer (1820-1903)
7. Henri-Louis Bergson (1859-1941)
8. Schumacher has described this issue from another perspective: "It is the sense of law-governed complexity that assimilates this work [an elegant composition] to the forms and spaces we perceive in organic as

well as in inorganic natural systems, where all forms are the result of lawfully interacting forces.”(Schumacher, 2007, 31).

9. For more information on the geometric elegance of the interior surfaces of Sheikh Lotfollah Mosque and change in motifs in the curved sections of corners, see “Safavid Surfaces and Parametricism”, Kaplan, 2011.

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HOW TO CITE THIS ARTICLE

Wahdattalab, M., Hashemi, T. & Ghadimzadeh, S. (2020). The Concept and Aspects of Manifestation of Elegance in Architecture (Case Study: Soltaniyeh Dome and Sheikh Lotfollah Mosque). *Bagh-e Nazar*, 16(81), 45-58.

DOI: 10.22034/BAGH.2019.176115.4042

URL: http://www.bagh-sj.com/article_103476_en.html

